HORIBA
Scientific

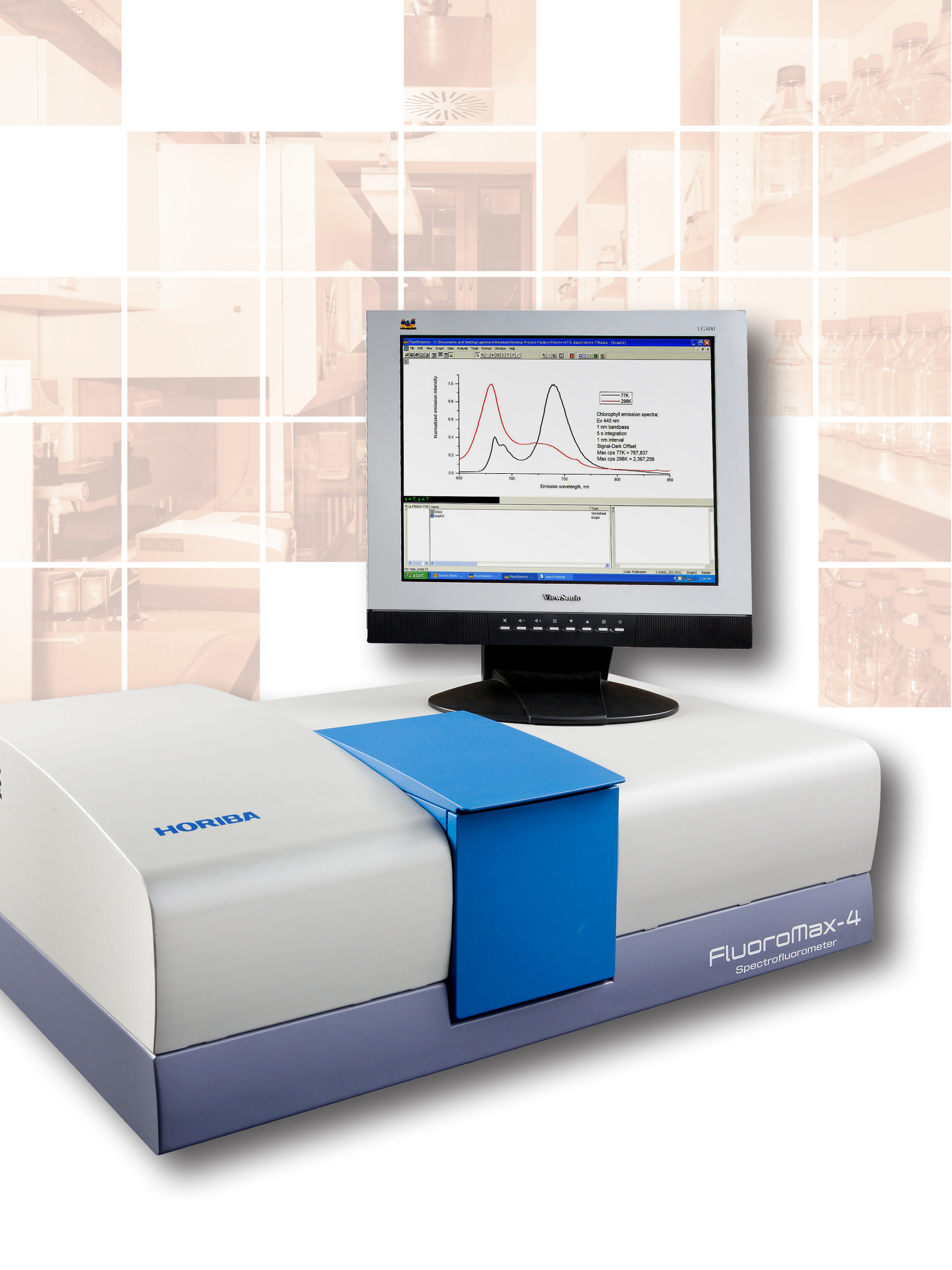
FluoroMax®–4 Series

Sensitive, Flexible, Easy-to-use Fluorometers

Powerful technology
with benchtop convenience

www.fluoromax.com

JOBIN YVON
Technology


VG800
77K
298K
Chlorophyll emission spectra:
Ex 440 nm
1 nm bandpass
5 s integration
1 nm interval
Signal-Dark Offset
Max cps 77K = 767,837
Max cps 298K = 2,367,256
Normalized emission intensity
Emission wavelength, nm
ViewSonic
HORIBA
FluoroMax-4
Spectrofluorometer

"The FluoroMax Series, from the most trusted name in fluorescence, offers unmatched sensitivity and unparalleled flexibility for all your lab's research needs."

FluoroMax® Series

The FluoroMax® series represents HORIBA's industry-leading spectrofluorometer performance in a convenient, affordable, easy-to-use benchtop model. The FluoroMax family, with its unique all reflective optics and photon counting, was the first to bring the sensitivity of a modular fluorometer to a tabletop unit.

Today, the FluoroMax series consists of the FluoroMax-4, the latest generation of the original, high performance tabletop fluorometer, and the new FluoroMax Plus, which offers extended performance with Time Correlated Single Photon Counting (TCSPC) lifetime measurements as short as 25 ps, or detection of emission spectra out to 1700 nm.

FluoroMax-based solutions are ideal for measuring solid and liquid samples, with high throughput screening, cryogenic or elevated temperatures, absolute quantum yields, microliter volumes, stopped flow mixing or titration, and even micron scale measurements using a microscope. With the industry's most extensive list of accessories, the FluoroMax series offers unparalleled flexibility to meet all of your lab's experimental needs.

Performance by design

Maximizing signal, Minimizing noise

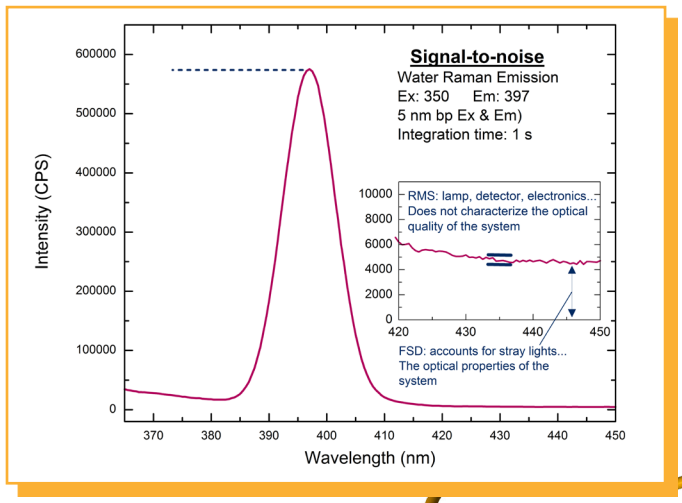
It can be confusing to try and compare the sensitivity of one instrument to another with the multiple specifications and differing definitions that pervade.

Sensitivity of a spectrofluorometer is generally reported as a minimum measurable concentration of a fluorophore (commonly Fluorescein), or the signal-to-noise ratio (S/N) of the Raman scattering peak of water. Most companies opt for the second, as it is a more readily verified number, especially in the field. Unfortunately, however, this specification can be confusing since two calculation methods prevail in the industry: First Standard Deviation (FSD) and Root Mean Square (RMS).

To avoid confusion, HORIBA quotes both specifications. And no matter how you look at it, the FluoroMax family has always offered the most sensitive benchtop fluorometers available. This is the result of an optimized design, the use of all reflective optics, photon counting detection, and the reduction of stray light by the use of HORIBA quality gratings and optical elements.

Sensitivity means speed

The real limit on how rapidly you can acquire data is not how fast you can scan the grating, but how long you have to measure at each wavelength to get an acceptable signal-to-noise. The higher sensitivity of the FluoroMax series means that not only can you measure weaker samples, but also that you can actually measure them faster than with lower sensitivity fluorometers with higher scanning speeds.



The Raman band of ultrapure water was measured in a standard 1 cm quartz cuvette. HORIBA qualifies its instruments with two measures of signal-to-noise: Root Mean Square (RMS) and First Standard Deviation (FSD) of light from its standard Xenon lamp source.

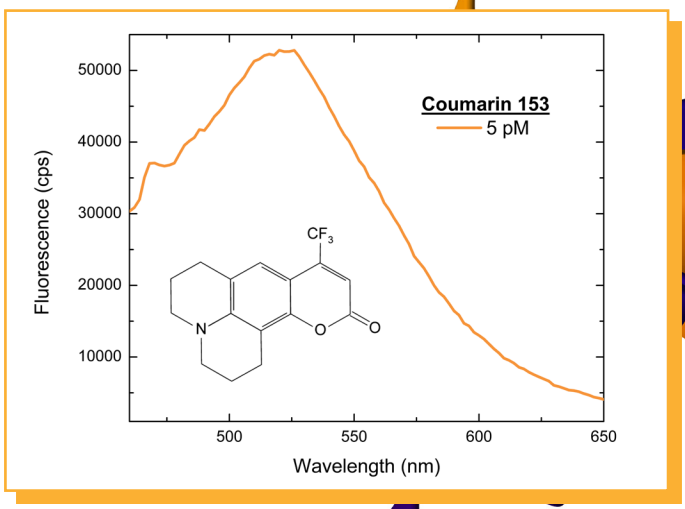
Measure smaller samples, detect smaller changes

Big discoveries come from small changes

Don't let your research get lost in the noise. Using the most sensitive fluorometer means having confidence in small changes in your data—the same small changes that drive curiosity and new discoveries.

Dilute and small volume samples

Higher sensitivity means you can also measure more dilute samples, or need less sample to begin with. Given the cost and effort often required for sample preparation, this means you save both time and money.

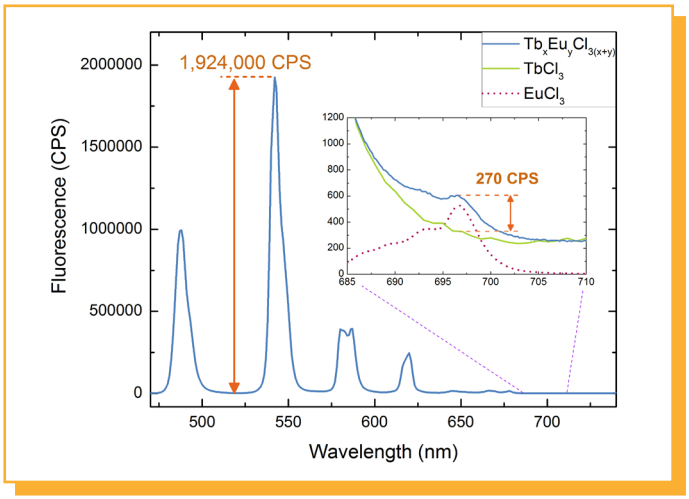


Coumarin 153 was serially diluted to a concentration of 5.0 pM in Ethanol. The spectrum shown represents the subtraction of fluorescence data from a blank to remove solvent background and Raman scatter.

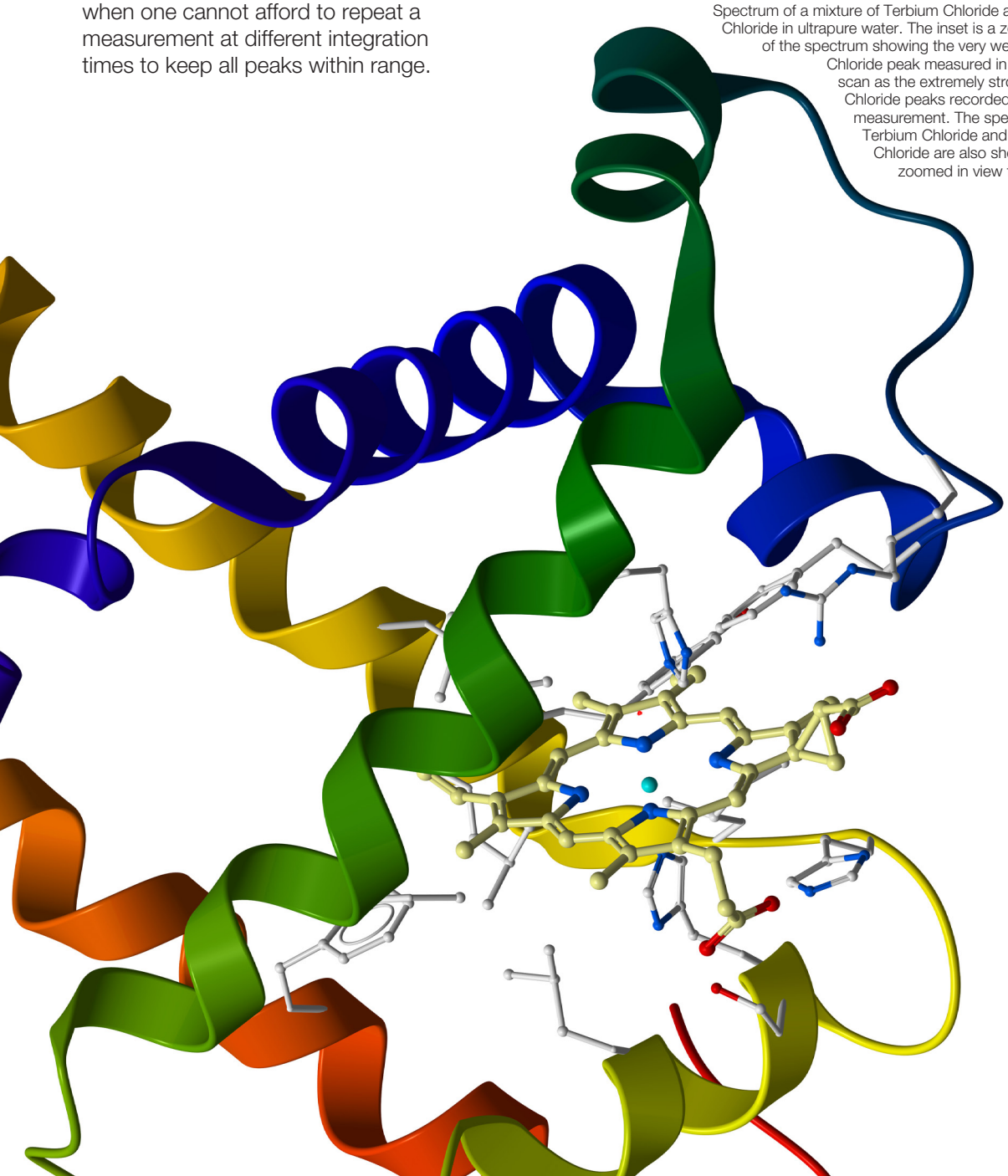
Dynamic Range

Measure more than 6 orders of magnitude of signal levels in the same spectrum

Fortunately not all samples are weak. Some samples are quite strong. But some are both, which creates a challenge to measure the strong and weak peaks in the same scan. With an intra-spectral range of over 6 orders of magnitude, even wildly varying multi-component spectra are no problem to measure in one scan. Not only does this save time, but it is essential for kinetics studies when one cannot afford to repeat a measurement at different integration times to keep all peaks within range.



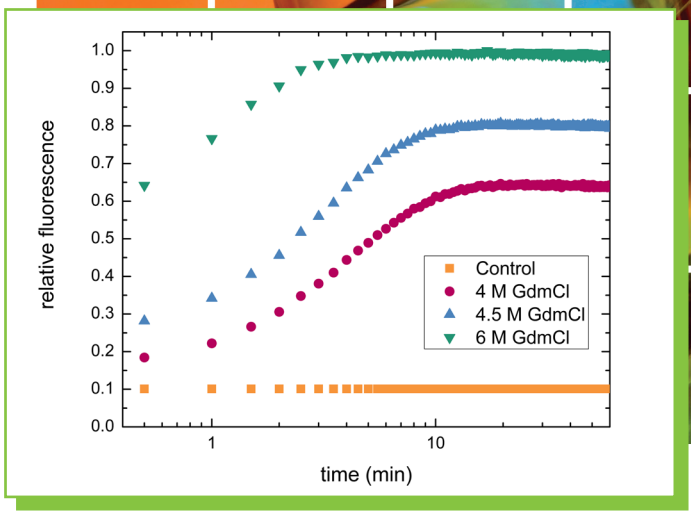
Spectrum of a mixture of Terbium Chloride and Europium Chloride in ultrapure water. The inset is a zoomed view of the spectrum showing the very weak Europium Chloride peak measured in the same scan as the extremely strong Terbium Chloride peaks recorded in the same measurement. The spectra of pure Terbium Chloride and pure Europium Chloride are also shown in the zoomed in view for reference.



Enhanced Measurements

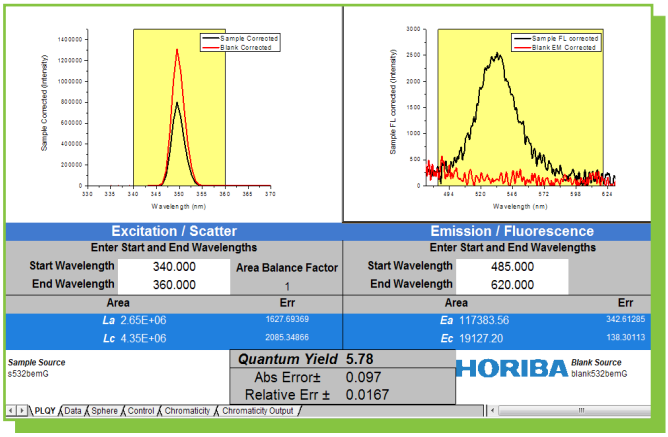
Kinetics

Measuring temporal variations in fluorescence spectra can yield information beyond that available from single time point measurements. For example, monitoring protein stability and folding in controlled solution conditions is crucial for developing targets for structure-based medicines. The FluoroMax series lets you measure dynamics on a scale of milliseconds to hours.



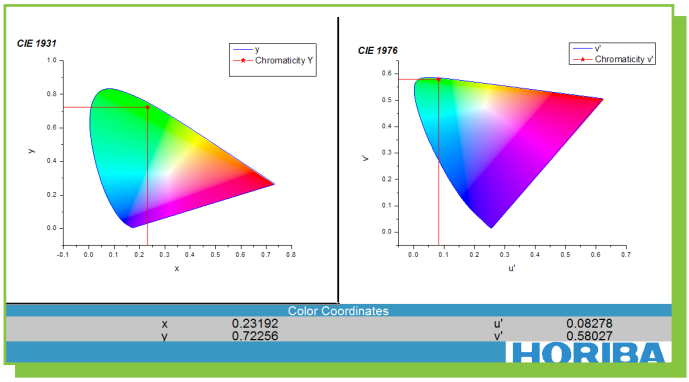
Kinetics of Lysozyme dissolved in several concentrations of the chaotrope, Guanidinium Hydrochloride, monitored by measuring native Tryptophan fluorescence simultaneously for 1 hour in a multi-sample changer. Data corrected for photobleaching using a control sample.

Absolute Quantum Yield Measurements

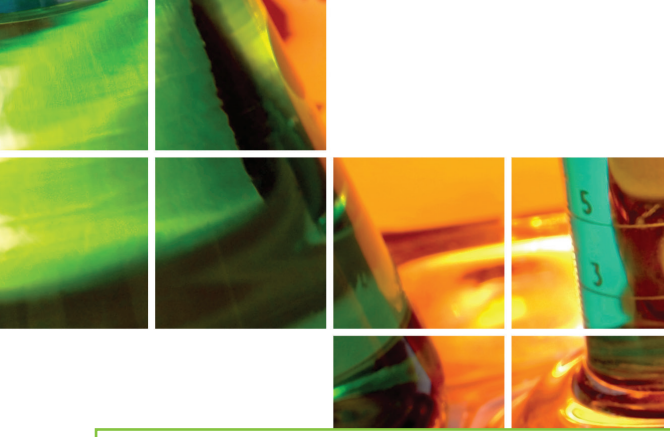


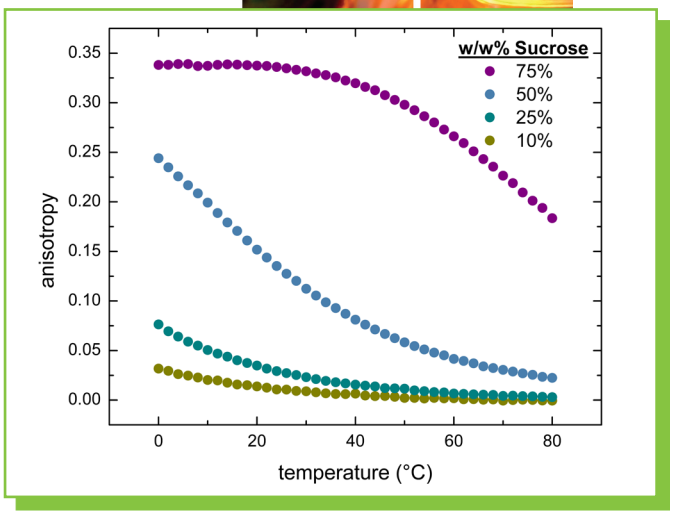
High precision absolute quantum yield characterization of a quantum dot sample enabled by the Quanta-φ integrating sphere accessory.

Measure absolute quantum yields (QY) with the only accessory optimized for liquids, powders, films, and solids. The Quanta-φ is based on a large 15 cm integrating sphere made of Spectralon® for the highest reflectivity over the broadest spectral range for the most accurate and reproducible QY values. The solid sample port can also accept wired sources for electroluminescence measurements.



FluoroMax software also automatically generates CIE 1931 and 1976 values for your sample.



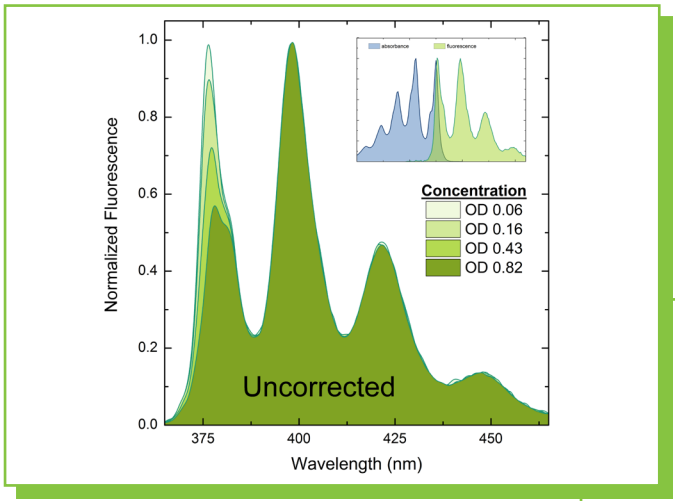


Fluorescein dissolved in four aqueous solutions of sucrose. With increased solution temperature, viscosity decreases, yielding faster rotation times and correspondingly lower anisotropies. Similarly, anisotropy is an excellent tool for understanding changes in macromolecule shape, as well as molecular binding.

Polarization

Adding optional polarizers to a FluoroMax allows anisotropy measurements and hence, the changes in sample rotation time. This indirect measure of the local viscosity gives information on sample aggregation, structural changes, molecular binding, and other mechanisms.

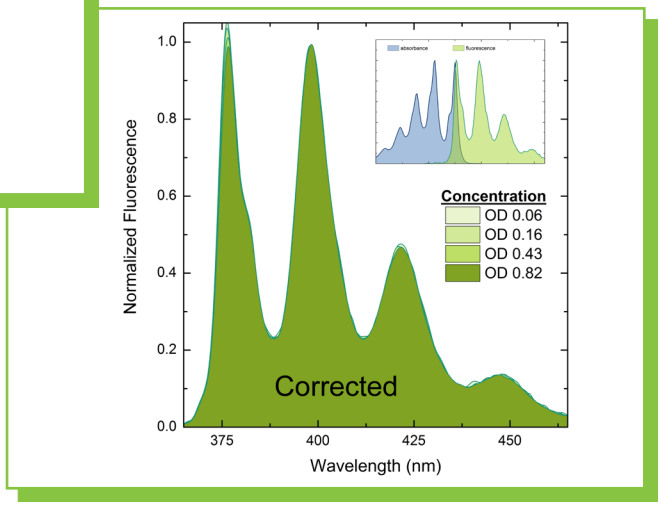
Absorbance/Transmittance Accessory



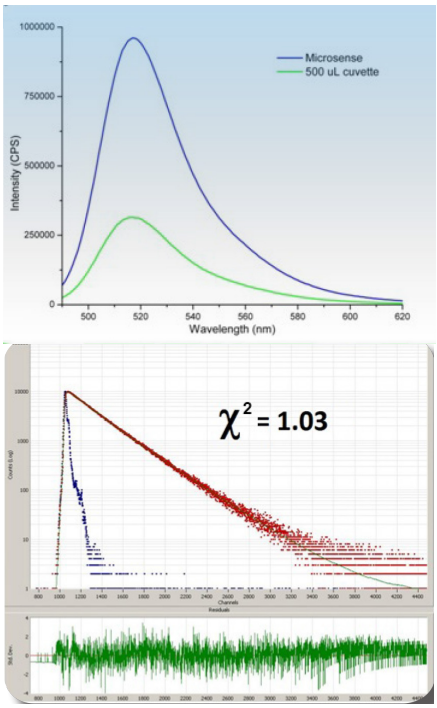
Reabsorption of fluorescence photons can occur even at moderate concentrations, and lead to increasing distortion of spectra with increasing concentration (left). The FluoroMax software can correct this phenomenon, (known as the inner-filter effect), using the sample absorbance measured by the absorbance accessory (right).

Add absorbance to your fluorescence measurement.

Correct your fluorescence spectra for inner-filter effects in concentrated samples without dilution.



Microvolumes



Using the Microsense, 5 µL of AlexaFluor 488 labeled IgG is enough to get steady-state or TCSPC data.

Measure ultra-low sample volumes with easy sample recovery

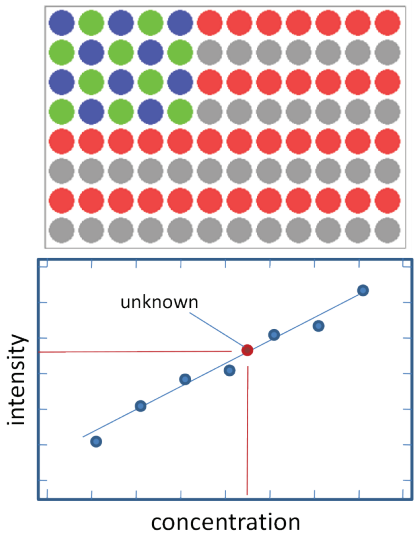
HORIBA's Microsense, the most advanced microliter accessory on the market, is designed to get cuvette-quality steady state or lifetime data from a 1-5 µL of sample.

Avoiding dilution and nearly total recovery minimizes the need for sample, while preserving measurement sensitivity. Based on all quartz optics, Microsense is compatible with UV to NIR measurements.

Well Plate Accessory

Maximize your throughput

Search for "hits" or automate measurements of a large number of samples.



The MicroMax 384 accessory lets you automate your measurements for high-throughput data collection. Based on standard microtiter well plates, MicroMax saves you time and money by automating spectral, kinetics, single point, and time-resolved measurements on anywhere from 6 to 384 samples at a time. FluoroMax software includes calibration curve routines for simple quantification of your results.

Full Spectral Microscopy

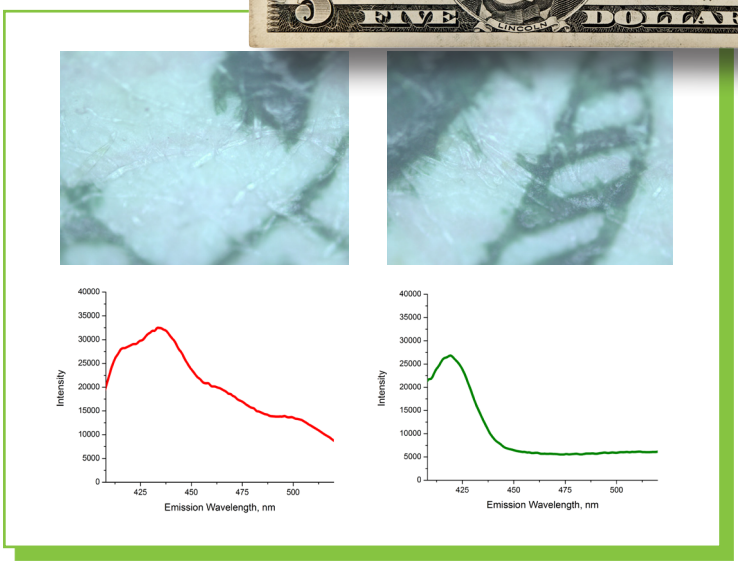
All instruments in the FluoroMax family can be fiber-coupled to virtually any upright or inverted microscope. Our confocal microscope coupling allows you to go beyond simple filter-based fluorescence microscopy to full spectral analysis of spatially varying or extremely small volume samples.

Couple a microscope to a FluoroMax and:

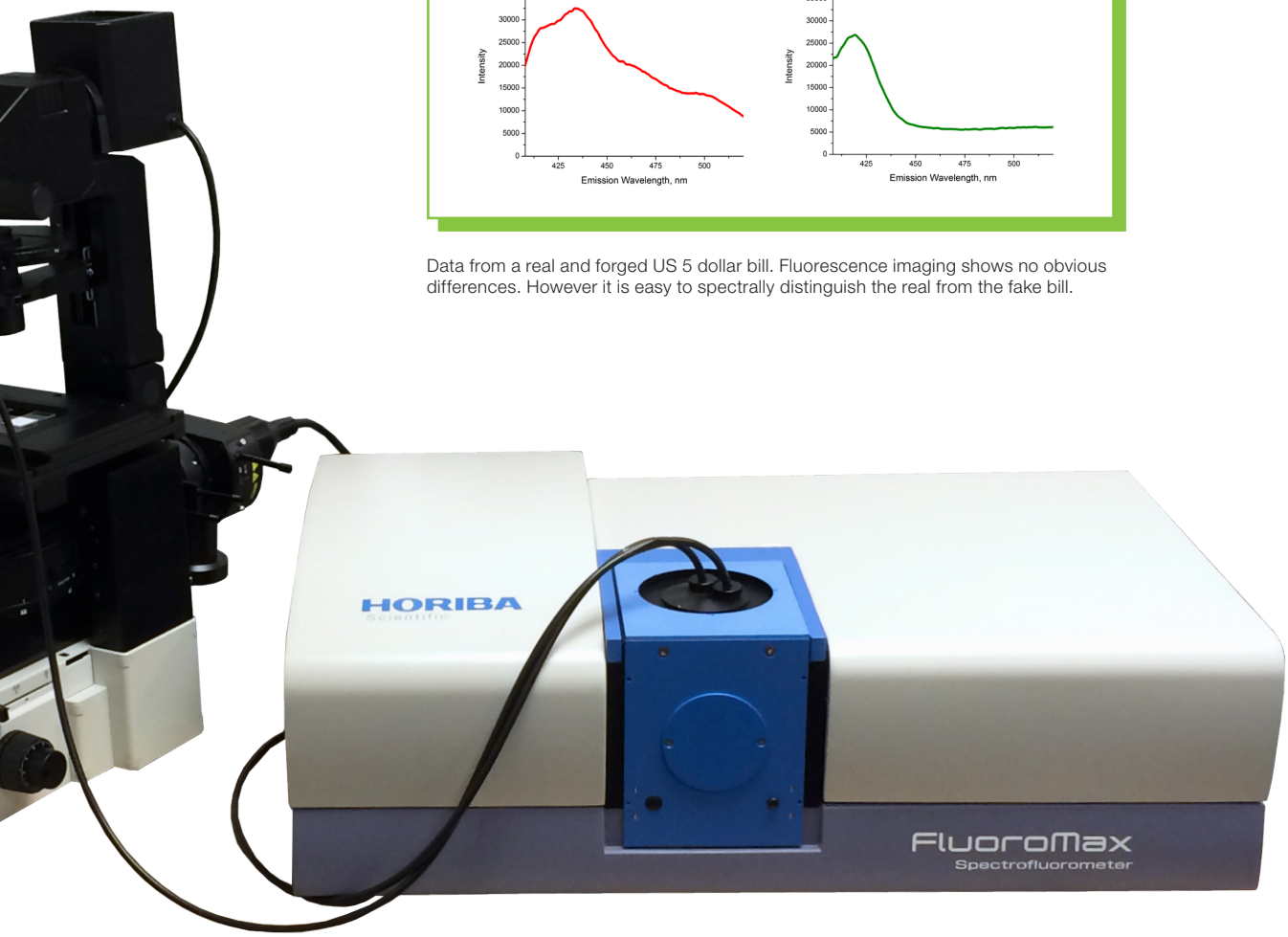
- Measure a complete spectrum of a sample as small as 1 µm.
- Get spectra from as little as a few molecules of sample.
- Perform localized FRET measurements.

Add an automated stage and camera, and:

- Create complete spatial/spectral maps.
- Perform repetitive QC characterization of structured samples like photovoltaics.



Data from a real and forged US 5 dollar bill. Fluorescence imaging shows no obvious differences. However it is easy to spectrally distinguish the real from the fake bill.



Flexibility

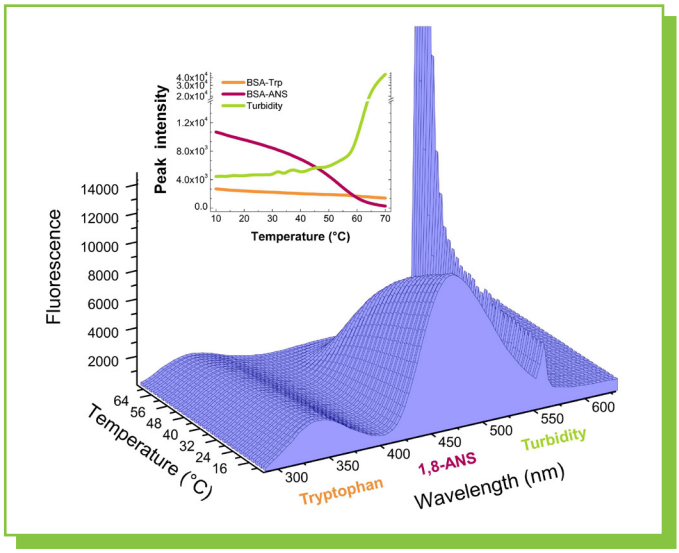
Enhanced Measurements

Peltier-based Heated/Cooled Cuvette Holders

Rapid temperature control in single or multiple cuvette models with built-in magnetic stirring.

Precise temperature control for precise data on your protein folding, micellization, solubility, conformation, phase, and rotational transitions.

Rapidly vary sample temperature over a range of -25 to 105°C (-40 to 150°C optional). FluoroMax software also simplifies automating temperature dependence measurements, including complex ramps and profiles.



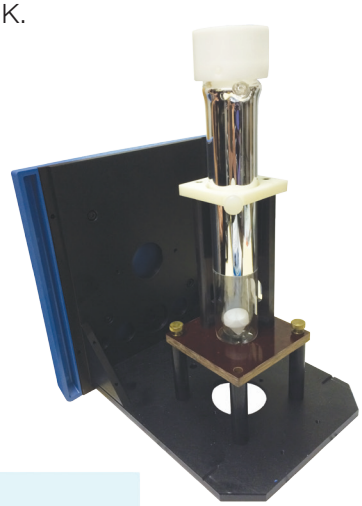
Thermal unfolding of Bovine Serum Albumin in PBS and 1,8-ANS followed using three observables: the quenching of intrinsic Tryptophan fluorescence by water, the quenching of the 1,8-ANS, and the increased 2nd order scattered light which reports turbidity from protein aggregation.

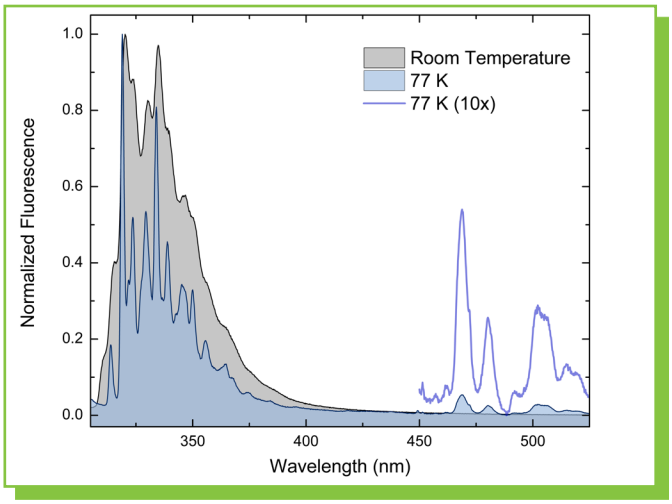
Temperature Bath

An alternative to Peltier-based units. Better precision (0.01°C), range (-25 to 100°C) and long term stability, but with much slower temperature ramping.

Economic LN Temperature Measurement Dewar Accessory

Cryogenic temperatures enable measurements of fine structure, enhanced phosphorescence, and rare conformations/ states often not possible at room temperature. This low cost accessory readily permits measurements of samples at 77 K.

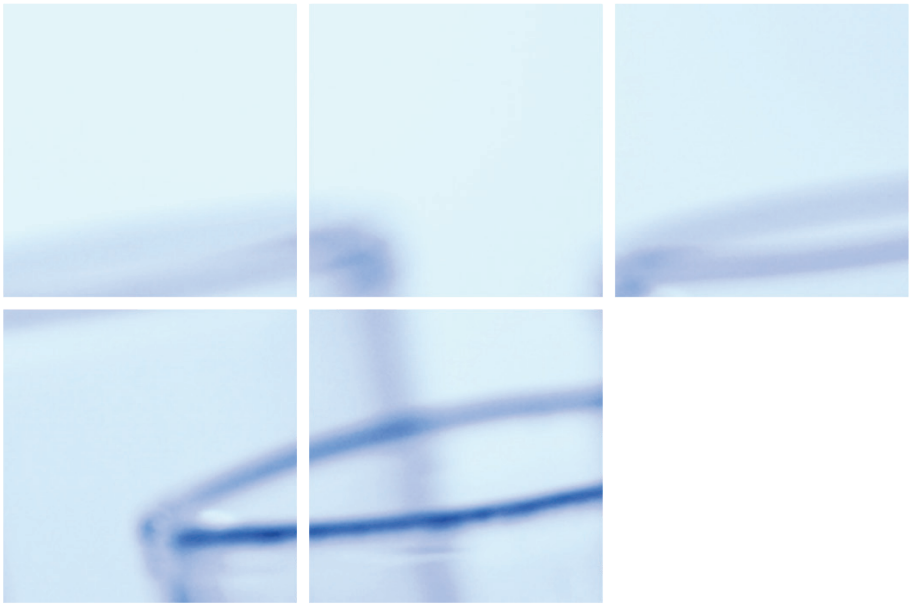




Temperature can add thermal broadening to fluorescence spectra and increase phosphorescence quenching. Spectra of Naphthalene dissolved in Methanol measured at room temperature (298 K) and in a liquid nitrogen dewar accessory (77 K). The low temperature spectrum reveals rich vibrational structure and longer wavelength phosphorescence. Phosphorescence peaks are also shown magnified 10x for clarity.

Optional LN_2 and He Cryostats

For greater temperature range and sample type flexibility, the FluoroMax supports various cryostats offering temperature control down to 4 K.



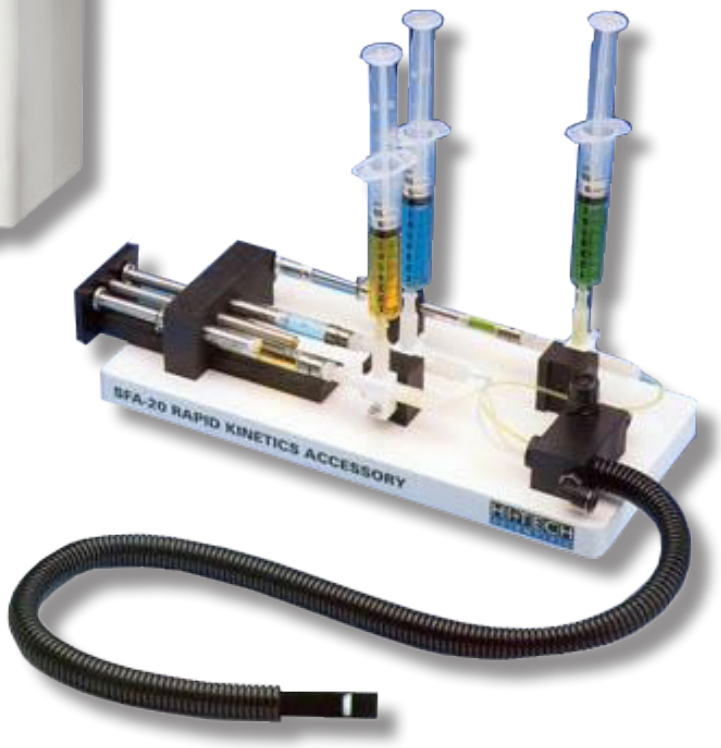
Flexibility

Temperature Control

Other Accessories

The FluoroMax series includes the most comprehensive line of accessories that enable researchers to extend the utility of their instrument to as many experiments as possible. The following is a partial list of accessories available, in addition to those previously discussed.

- Auto-titrator (injector) dual syringe, dual valve
- Hi-Tech SFA-20 Stopped Flow, rapid kinetics accessory
- Solid Sample Holder designed for viewing front-face fluorescence of thin films, powders, pellets, paper, fibers, or microscopic slides. Variable alignment angle.
- 2-position sample holder with magnetic stirring bar
- 4-position sample holder with magnetic stirring bar
- 250 µl reduced volume cell
- 500 µl cuvette 5x5 mm
- 20 µl HPLC flowcell
- Fiber Optic Probe, bifurcated, randomized. Ideal for samples which cannot fit inside a standard sample chamber. Requires fiber adapter.
- Sealed water standard in scratch-proof housing for water Raman S/N verification
- Emission correction factor kit
- Excitation correction factor kit
- Purge port, quartz windows for sample compartment for use with nitrogen purging.



The FluoroMax Plus

Extend the spectral or lifetime range of your FluoroMax

The FluoroMax Plus is the most flexible member of the FluoroMax series. In addition to all the capabilities of the FluoroMax-4, the PLUS adds the option of a second detector and a 2-position grating turret. Add a cooled NIR detector, and extend the FluoroMax emission range to up to 1.7 µm. Take advantage of this extended range with a second software-selectable NIR optimized grating. Or choose one of our proprietary PPD series TCSPC detectors for measuring lifetimes as short as 25 ps.

Available detectors

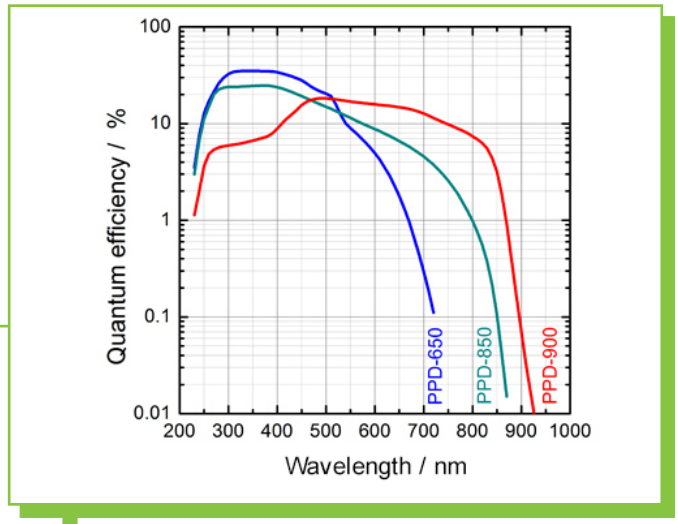
NIR: A broad range photomultiplier covering 200-1050 nm
Extended NIR: Choose from 950-1400 nm or 950-1700 nm

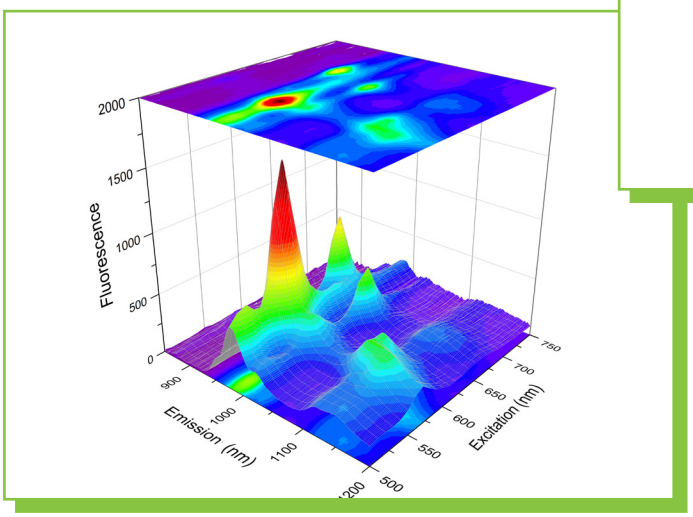
PPD:

PPD-650	PPD-850	PPD-900
230-700 nm	230-850 nm	300-910 nm

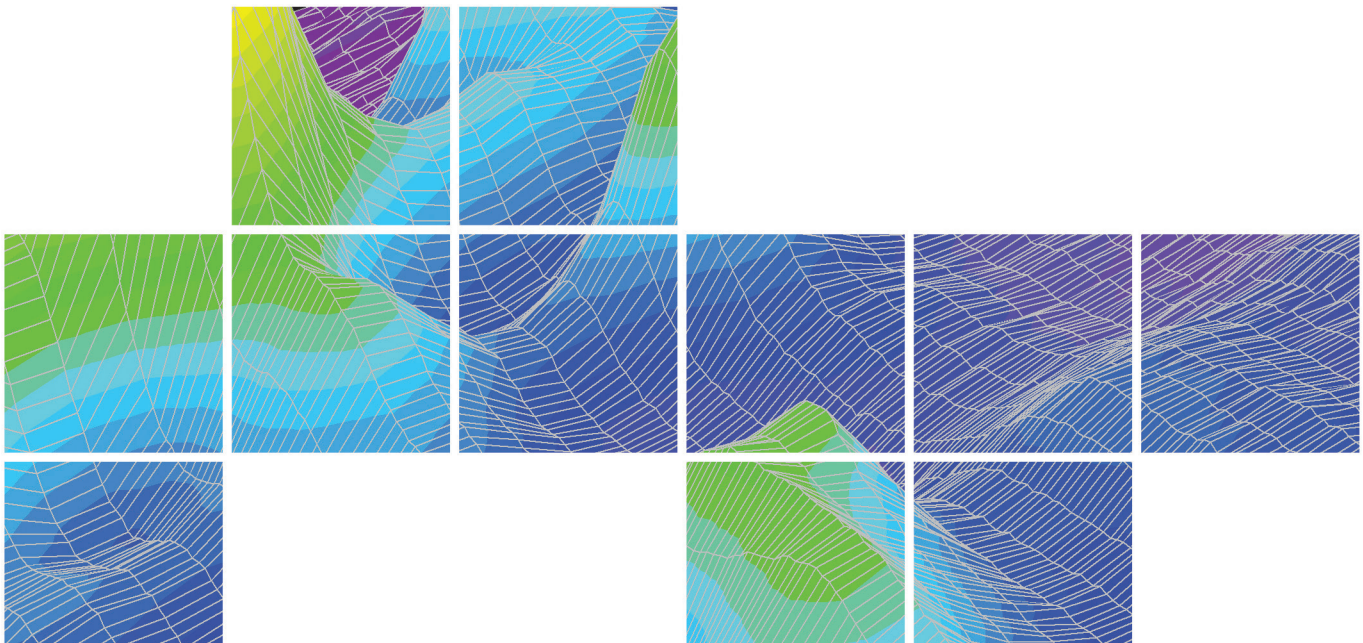
Two-position turret available gratings

- 1200 grooves/mm blazed at 500 nm
- 600 grooves/mm blazed at 1 µm, gold coated for optimized NIR response
- Other gratings available on special order basis





Well characterized NIR peaks from single-walled carbon nanotubes (SWCNT) on an excitation emission matrix (EEM) acquired using optional extended NIR detector.



Flexibility

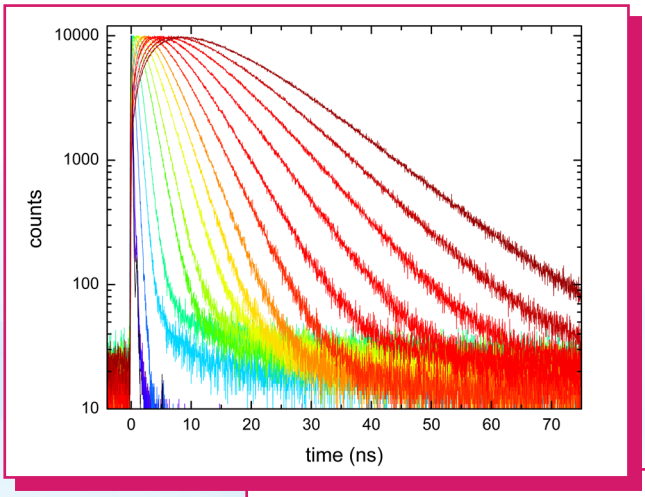
Accessories

Take your measurements to the next dimension: Time

TCSPC

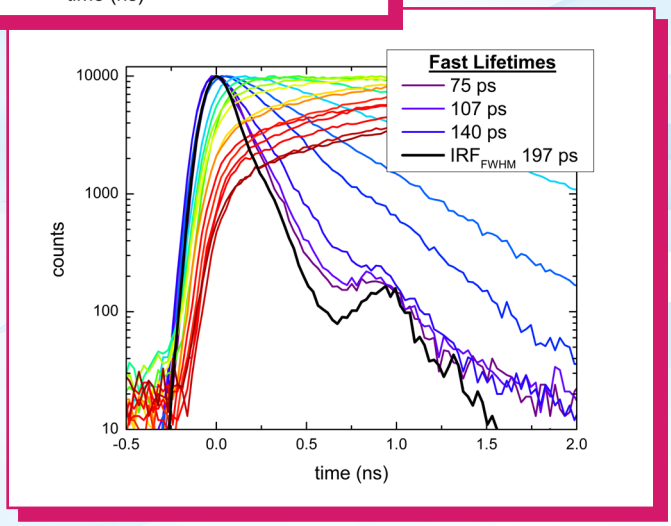
(Time Correlated Single Photon Counting)

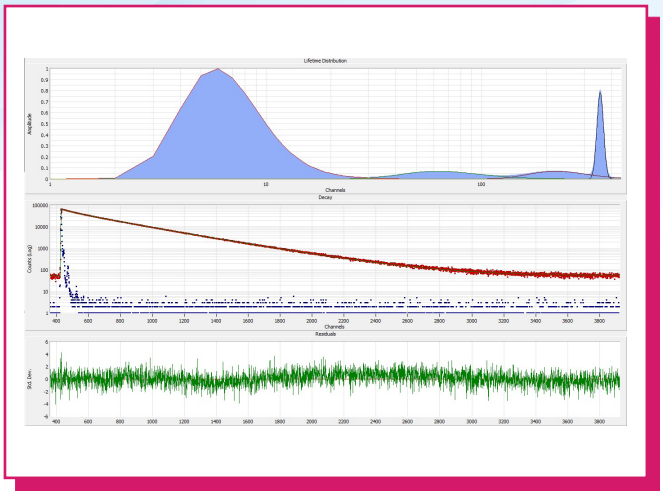
- 40 years of experience in TCSPC innovation
- Industry-leading true 100 MHz system operation allows for millisecond acquisition time
- Robust data, independent of concentration and photobleaching.
- Lifetimes from 25 ps to seconds.
- Unique SpectraLEDs for highest efficiency phosphorescence measurements.
- TCSPC lifetimes, anisotropy, TRES, and kinetics.



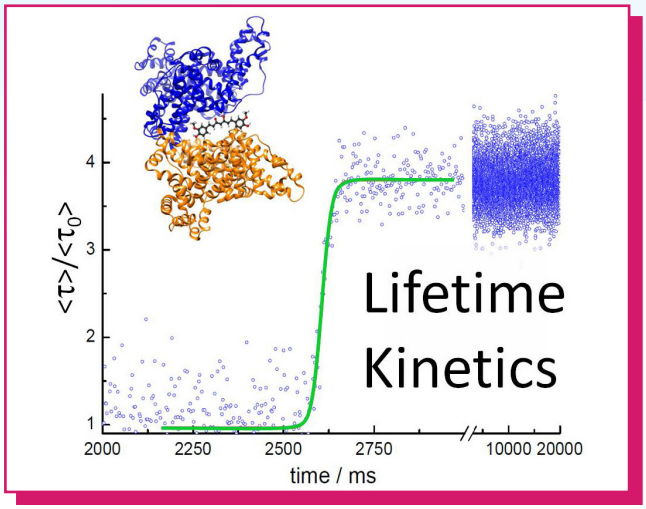
Lifetimes of Rhodamine 6 G in Methanol measured using optional ultrafast PPD detector. At high concentrations, self-quenching results from homodimers and trimers formation. Lifetimes as short as 75 ps are seen, as well as homo-FRET at lower concentrations.

Add lifetime measurement to any FluoroMax with the DeltaTime™ TCSPC accessory. Working in the time domain removes the confounding influences of concentration and photobleaching. DeltaTime has the same footprint as a mouse pad, but is powerful enough to deliver 12 decades of lifetimes. With its industry-leading true 100 MHz system operation, DeltaTime offers TCSPC acquisition rates, with all decays being acquired in mere milliseconds, allowing for TCSPC lifetime kinetics of fast reactions. Its crystal-locked timing circuits never require recalibration. Select from our current catalog of over 70 compact pulsed light sources, with more being added all the time. And once you get your data, powerful DAS6 analysis software lets you choose among 9 fitting models.

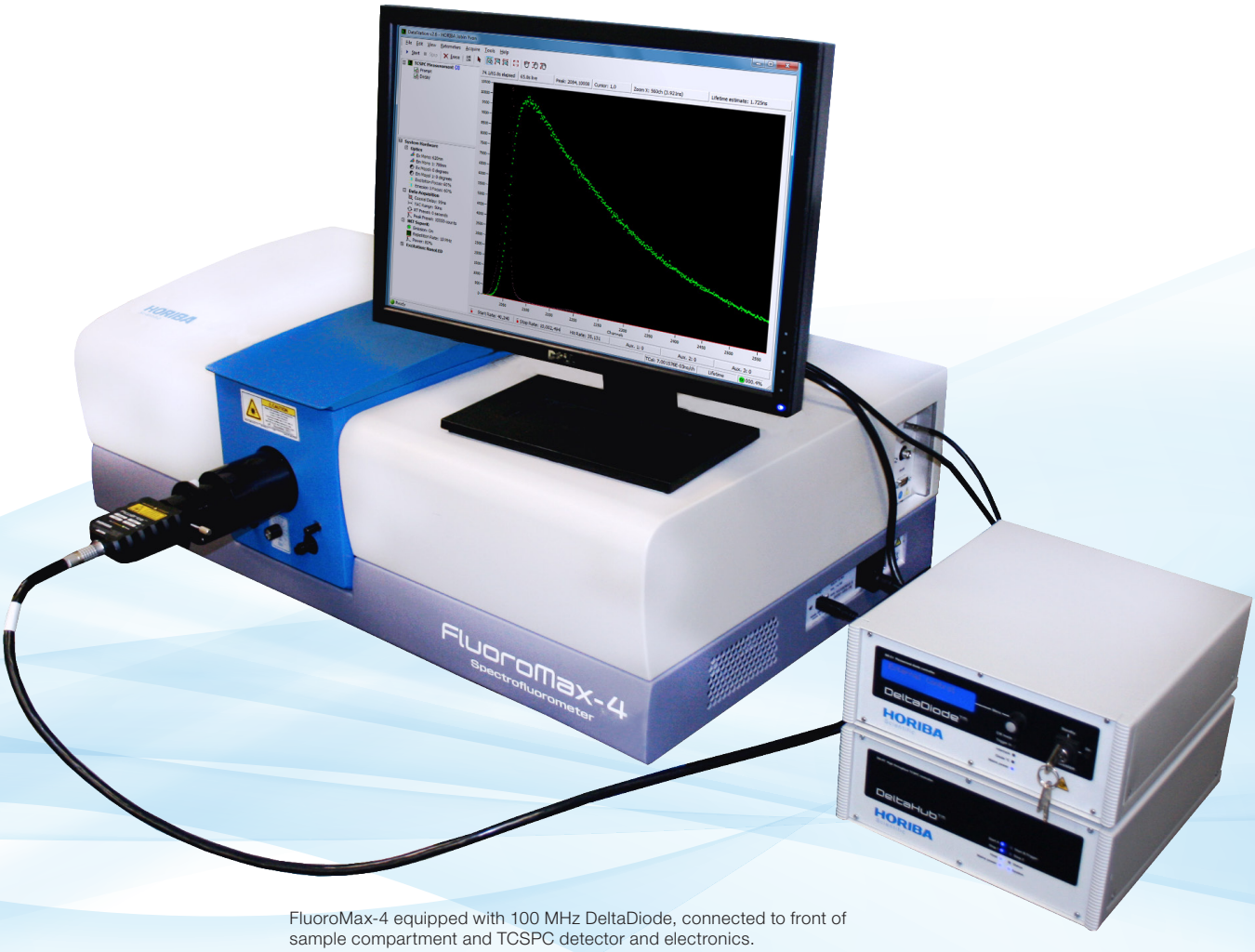




Non-extensive distribution fits: 1,8-ANS exists in free solution and partitions into several disparate environments in Bovine Serum Albumin. Within each environment, a distribution of states exists with a corresponding distribution of lifetimes. FluoroMax software not only offers standard discrete exponential fitting but also several energy transfer and distribution models, including the proprietary non-extensive distribution shown here.



Sample photobleaching corrupts kinetic data by adding an exponential term. Lifetimes are more robust than steady-state intensities. To support rapid kinetics, the FluoroMax is capable of measuring a complete lifetime decay in as little as every 10 ms. Example shown is the binding of Curcumin to Serum Albumin.

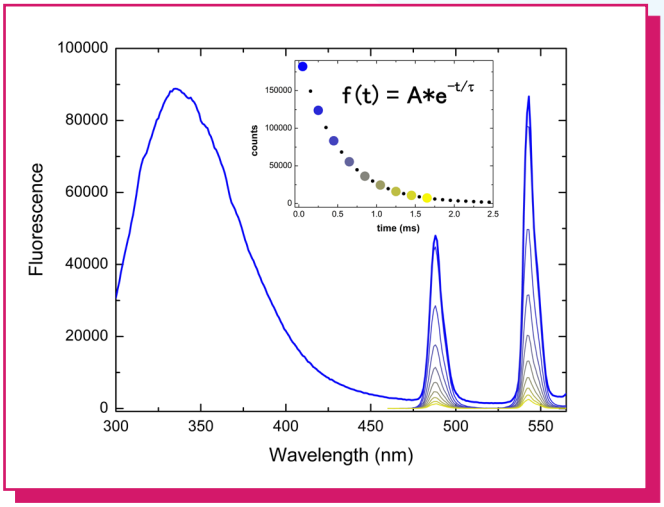


FluoroMax-4 equipped with 100 MHz DeltaDiode, connected to front of sample compartment and TCSPC detector and electronics.

Phosphorescence

Measure phosphorescence spectra, lifetimes from microseconds to seconds.

The FluoroMax series “P” versions add an optional pulsed xenon flash lamp, enabling lifetime measurements down to 10 µs with no additional electronics or detectors. Ideal for measuring lanthanide tagged samples or rare earth phosphors used in lighting applications.



Complex solutions like this mixture of Bovine Serum Albumin (BSA) and Terbium Chloride can be challenging to interpret. Using the pulsed light source of the Phosphorescence option allows you to temporally “gate out” the BSA fluorescence, leaving only the Tb^{3+} phosphorescence. Inset shows the single wavelength phosphorescence decay of Tb^{3+} in this mixture; colored circles correspond to the gated spectra in the main figure.

FluorEssence™ Software

Simple enough for the occasional user; Powerful enough for the most elaborate experiments.

Fluorescence software that works like you do

- Efficiently develop your experimental method, and then save it for future use.
- Data collection, analysis and report generation are easily streamlined.
- Full software control of accessories.
- Automate repetitive experiments with a built-in batch mode.
- All instrument calibration parameters are automatically applied per method.
- Of course, all experimental parameters are always saved along with the data file for comparison with previously collected data.

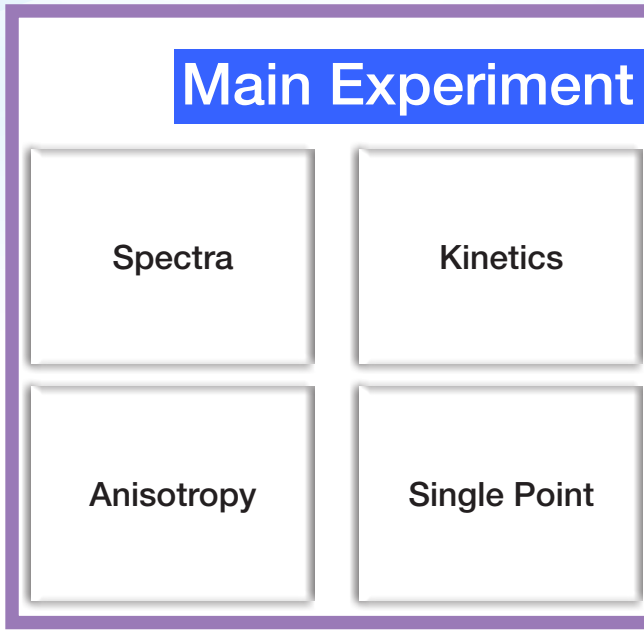
Convert data to answers

Powerful processing and data-management tools of OriginPro™ include a complete suite of data reduction tools.

A complete library of video tutorials to get you started

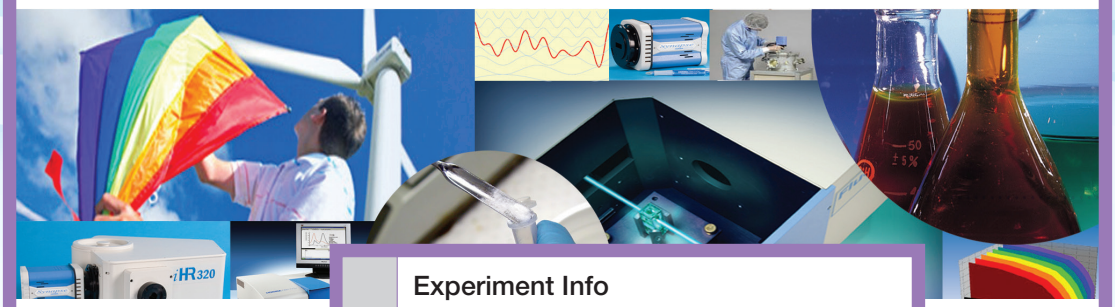
Features

- Data views in workbook formats, keeping graphs, tables and notes together for each experiment
- Zooming and scaling
- Contour maps and profiles from 3D plots
- Peak finding
- Integrate, differentiate, or fit fluorescence data to Gaussian, Lorentzian, and custom curves
- Standard arithmetic
- 3D perspective
- Smoothing
- Deconvolution
- Excitation/emission correction
- Interpolation and extrapolation
- Blank subtraction
- Normalization
- PLQY calculator wizard (for use with Quanta-φ™ accessory)



HORIBA Scientific

FluorEssence™ for Windows®



Menu

3D

Phos

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- Absorbance/Transmission
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- SphereCorrect
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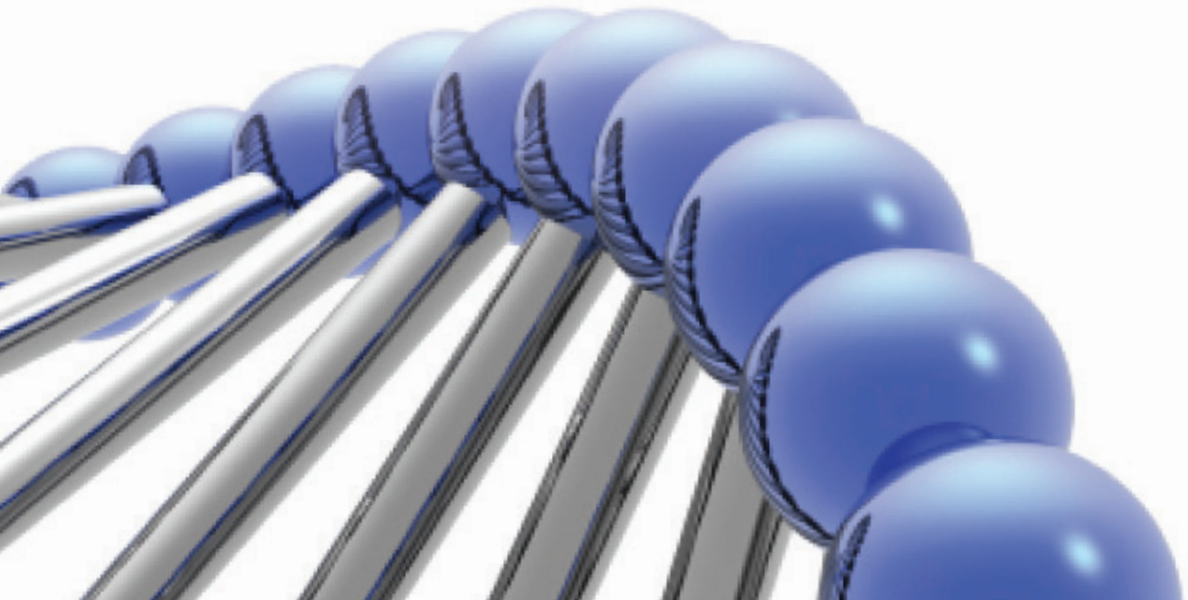
FluoroMax-*4* Specifications

Optics	All reflective optics for high sensitivity at all wavelengths and for microsamples
Source	150 W CW Ozone-free xenon arc lamp
Monochromators	Czerny-Turner design with plane gratings for optimized focus at all wavelengths and minimum stray light
Excitation grating	1200 groove/mm blazed at 330 nm
Emission grating	1200 groove/mm blazed at 500 nm
Bandpass	0 to 30 nm, continuously adjustable
Wavelength Accuracy	± 0.5 nm
Integration Time	1 ms to 160 s
Base detector	Photomultiplier R928P, spectral coverage 200 – 870 nm,
Reference Detector	UV-enhanced silicon photodiode
Transmission Detector (optional)	UV-enhanced silicon photodiode
Water Raman S/N	16,000:1 RMS method (6,000:1 FSD)
Dimensions	83 cm (w) x 28 cm (h) x 48 cm (d)
Weight	34 kg
Lifetime Options	
TCSPC:	
Lifetime range with standard detector	< 150 ps to 1 s
Phosphorescence:	
(FluoroMax-4 P model)	< 10 µs to >10 s

FluoroMax *Plus* Specifications

Optics	All reflective optics for high sensitivity at all wavelengths and for microsamples
Source	150 W CW Ozone-free xenon arc lamp
Monochromators	Czerny-Turner design with plane gratings for optimized focus at all wavelengths and minimum stray light
Excitation grating	1200 groove/mm blazed at 330 nm
Emission grating	1200 groove/mm blazed at 500 nm
Optional second grating	600 groove/mm blazed at 1 µm, gold coated, on a computer controlled turret
Bandpass	0 to 30 nm, continuously adjustable
Wavelength Accuracy	± 0.5 nm
Integration Time	1 ms to 160 s
Base detector	Photomultiplier R928P, spectral coverage 200 – 870 nm,
Reference Detector	UV-enhanced silicon photodiode
Optional Cooled NIR PMT detector	200 nm to 1050 nm
Optional Cooled Extended NIR PMT detector	950 nm to 1700 nm
Transmission Detector (optional)	UV enhanced silicon photodiode
Water Raman S/N	16,000:1 RMS method (6,000:1 FSD)
Dimensions	83 cm (w) x 28 cm (h) x 48 cm (d)
Weight	34 kg
Lifetime Options	
TCSPC:	
Lifetime range with standard detector	<150 ps to 1 s
Lifetime range with optional PPD detector	<25 ps to 1 s
Phosphorescence:	
(FluoroMax Plus P model)	<10 µs to >10 s

HORIBA Scientific has a policy of continuous product development, and reserves the right to amend part numbers, descriptions and specifications without prior notice.



Specifications

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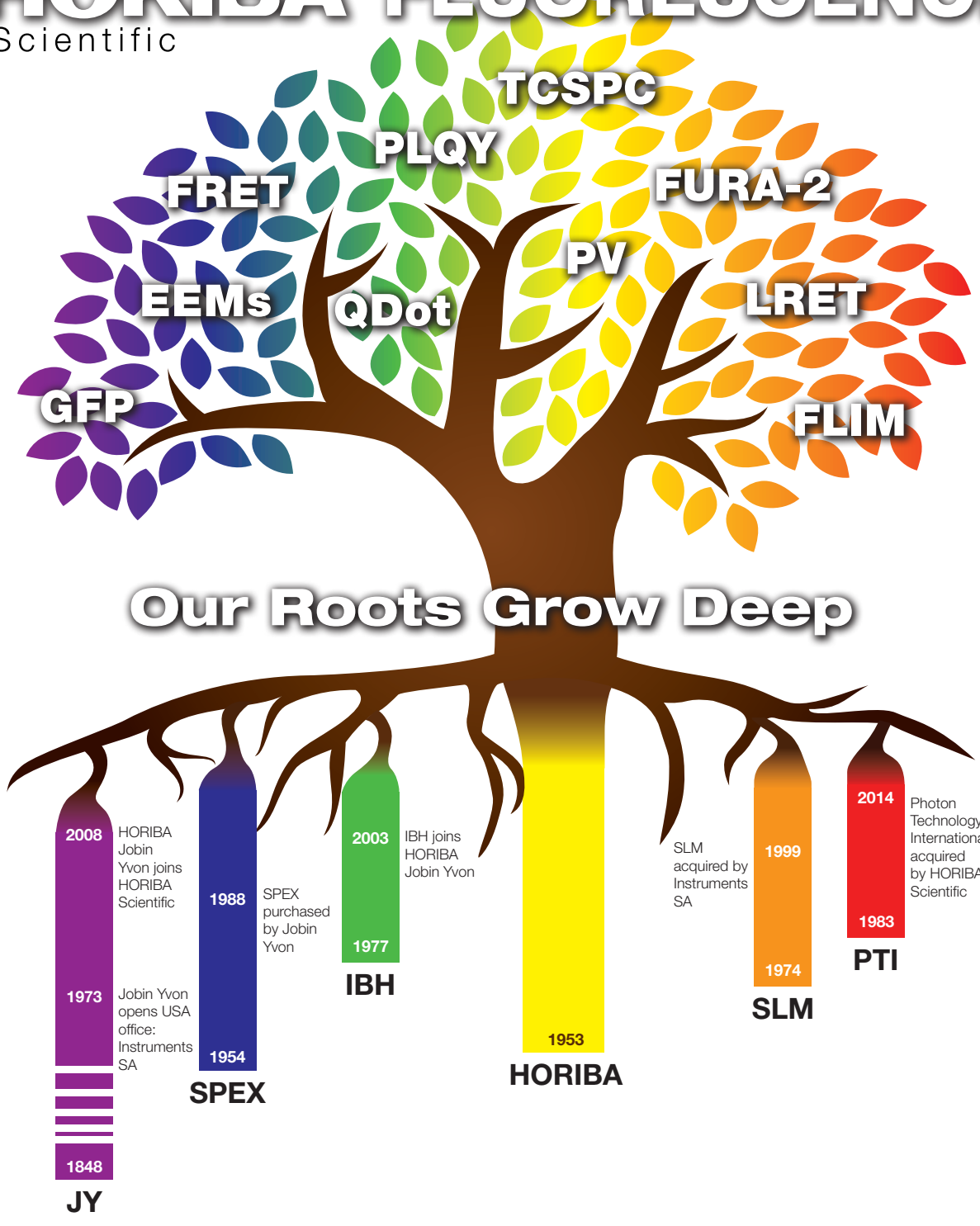

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